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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/773,183

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Kia Silverbrook

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11/07/2006

SILVERBROOK RESEARCH PTY LTD
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AUSTRALIA

EXAMINER

FIDLER, SHELBY LEE

ART UNIT

PAPER NUMBER

2861

DATE MAILED: 11/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/773,183

Applicant(s)

SILVERBROOK, KIA

Examiner

Shelby Fidler

Art Unit

2861

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 August 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6, 8, 10-22, 24, 25, 27, 29-44 and 46-54 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6, 8, 10-22, 24, 25, 27, 29-44 and 46-54 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 6/21/06 & 7/3/06.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application
- ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 8, 11, 27, and 30 are objected to because of the following informalities: these claims recite the limitation "a said bubble." Please change to "said bubble." Claims 8 and 27 further recite the limitation "a said drop." Please change to "said drop." Appropriate correction is required.

Claims 12 and 31 recite the limitation "each element" in line 1. There is insufficient antecedent basis for this limitation in the claim. Please change to "each heater element."

Claims 15, 34, and 51 are objected to because of the following informalities: These claims recite the limitation "comprising a plurality of nozzle." However, according to the instant specification, the terms "bubble forming chambers" and "nozzle chambers" are used interchangeably. Since the "bubble forming chambers" have been disclosed in parent claim 1, please replace all recitations of "nozzle chambers" to "bubble forming chambers." Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

Art Unit: 2861

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5, 11-13, 17, 19-22, 24, 30-32, 36, 38-42, 47, 48, 50, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. (US 4870433) in view of Lebens et al. (US 6631979 B2) and DeMoor et al.

Regarding claims 1, 17, 19, 36, 38, and 53:

Campbell et al. disclose an inkjet printhead comprising:

a plurality of nozzles (nozzles 19; col. 3, lines 1-3 and col. 2, lines 17-21), each having a respective bubble forming chamber (print cavity 21; Fig. 2);

at least one heater element (resistive heater elements 12) disposed in each of the bubble forming chambers respectively (Fig. 2), the heater element configured for thermal contact with a bubble forming liquid (ink; col. 3, lines 8-11);

drive circuitry (electrodes 15 and 16) corresponding to each of the nozzles (col. 2, lines 57-59 and Fig. 3) for controlling the operation of the heater element (col. 3, lines 8-11);

heating the heater element to a temperature above the boiling point of the bubble forming liquid forms a gas bubble (bubble 22) that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 3, lines 8-13); wherein

part of the drive circuitry (common electrode 15) is disposed on one side of the bubble forming chamber (Figs. 1-3); and

part of the drive circuitry (individual electrode 16) is formed on the opposing side of the bubble forming chamber (Figs. 1-3);

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to the cyclic ejections of col. 3, lines 3-7 and col. 4, lines 64-68); and

Campbell et al. do not expressly disclose that the heater element is in the form of a cantilever beam.

However, Lebens et al. disclose a heater element (cantilevered element 20) in the form of a cantilever beam (Fig. 10).

Campbell et al. as modified by Lebens et al. do not expressly disclose a heater element of less than 10 nanograms.

However, DeMoor et al. disclose a heater element of less than 2 nanograms (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000 μ m; heater width = 0.4 μ m. Therefore, the volume of Ti within the heater is 4×10^{-12} cm³, and the volume of TiN within the heater is 2.4×10^{-11} cm³. Using the known densities of Ti = 4.54 g/cm³ and TiN = 5.22 g/cm³, the heater element has an entire mass of 0.14344 ng).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element in the form of a cantilever beam (Lebens et al.) and a heater element of less than 2 nanograms (DeMoor et al.) into the invention of Campbell et al. The motivation for doing so, as taught by Lebens et al., is to operate the

Art Unit: 2861

thermal actuator at reduced energy and acceptable peak temperatures (col. 2, lines 58-62). The motivation for doing so, as taught by DeMoor et al., is that these types of heaters show excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Regarding claims 2, 20, and 39:

Campbell et al. also disclose that the heater elements (12) and bubble forming chambers (21) are symmetrical about a longitudinal plane (Figs. 1-3).

Regarding claims 3, 21, and 40:

Campbell et al. also disclose that the bubble forming chamber (21) has a circular cross section (Fig. 1) wherein the heater element (12) has at least one arcuate section (elongated portions 31) that is concentric with the longitudinal axis of the bubble forming chamber (Fig. 3) such that during use, the arcuate section forms a disc-shaped bubble (bubble 22; col. 3, lines 50-58) with a point of collapse substantially on the central axis of the bubble forming chamber (col. 3, lines 60-64).

Regarding claims 4, 22, and 41:

Campbell et al. also discloses that the gas bubble (22) encircles at least some of the heater element (col. 3, lines 54-57 and Fig. 2).

Regarding claims 5, 24, and 42:

Campbell et al. also disclose that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 3, lines 8-13).

Regarding claims 11, 30, and 47:

Campbell et al. also disclose that each heater element (12) has two opposite sides (e.g. top side and bottom side of Fig. 3) and is configured such that the gas bubble formed by the heater element is formed at both sides of the heater element (col. 3, lines 50-60 and Fig. 3).

Regarding claims 12, 31, and 48:

Campbell et al. also disclose that the bubble (22) is collapsible and has a point of collapse, and wherein each heater element (12) is configured such that the point of collapse is spaced from any solid surface of the heater elements (col. 3, lines 60-64).

Regarding claims 13, 32, and 50:

Campbell et al. also disclose a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Examiner notes the limitation that the structure is formed by chemical vapor deposition. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself or the method of using the device; therefore, Examiner has not given this limitation patentable weight.

Claims 6, 8, 10, 14, 25, 27, 29, 33, 43, 44, 46, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lebens et al. and DeMoor et al., as applied to claim 1 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all claimed limitations except that the printhead is configured as a pagewidth printhead.

However, Silverbrook discloses a pagewidth printhead (head 200) configured to print on a page (col. 6, lines 7-12).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead into the invention of Campbell et al. as modified by Lebens et al. and DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

Regarding claims 8, 27, and 44:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all claimed limitations except that the heater elements are configured such that an actuation of less than 500 nJ is required to be applied to the heater elements so as to form the bubble in the bubble forming liquid to cause the ejection of the drop.

However, Silverbrook discloses heater elements (heaters 120; Fig. 10) that are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (200 nJ; col. 19, lines 8-9).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements that require less than 500 nJ to heat the heater element to eject a drop into the invention of Campbell et al. as modified by Lebens et al.

Art Unit: 2861

and DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced without affecting print speed (col. 19, lines 9-10).

Regarding claims 10, 29, and 46:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all claimed limitations except that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the “part of cyan” section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter:

$$\frac{20\text{nozzles}}{0.0016384\text{cm}^2} = 12207 \frac{\text{nozzles}}{\text{cm}^2}.$$

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Campbell et al. as modified by Lebens et al and DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

Regarding claims 14, 33, and 49:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all the limitations of claim 1, and Campbell et al. also disclose a structure (substrate 18), wherein the nozzles (19) are incorporated on the structure (col. 3, lines 1-3 and Fig. 2).

Campbell et al. as modified by Lebens et al. and DeMoor et al. do not expressly disclose that the structure is less than 10 microns thick.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure incorporating nozzles that is less than 10 microns thick into the invention of Campbell et al. as modified by Lebens et al. and DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Claims 15, 16, 18, 34, 35, 37, 51, 52, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Campbell et al. as modified by Lebens et al. and DeMoor et al., as applied to claim 1 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

Regarding claims 15, 34, and 51:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all claimed limitations except a plurality of heater elements disposed within each bubble

Art Unit: 2861

forming chamber, the heater elements within each chamber being formed on different respective layers to one another.

However, Anagnostopoulos et al. disclose a plurality of the heater elements (notch type heaters) disposed within a bubble forming chamber (col. 8, lines 36-37), the heater elements within each chamber being formed on different respective layers to one another (col. 8, lines 36-38).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a plurality of heater elements in each bubble forming chamber into the invention of Campbell et al. as modified by Lebens et al. and DeMoor et al. The motivation for doing so, as taught by Anagnostopoulos et al., is to provide two heaters able to fire simultaneously or at different times (col. 8, lines 42-47).

Regarding claims 16, 35, and 52:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all claimed limitations except that the heater elements are formed of solid material more than 90% of which is constituted by at least one periodic element having an atomic number below 50.

However, Anagnostopoulos et al., discloses heater elements formed of solid material more than 90% of which is constituted by at least one periodic element, having an atomic number below 50 (Ti and TiN, col. 10, lines 31-33).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements formed of Titanium and Titanium Nitride into the

Art Unit: 2861

invention of Campbell et al. as modified by Lebens et al and DeMoor et al. The motivation for doing so, as taught by Chan (US 5710070), is that the titanium/titanium nitride resistive layer provides good electro-migration performance to sustain high current density at high temperatures (col.3, lines 30-33).

Regarding claims 18, 37, and 54:

Campbell et al. as modified by Lebens et al. and DeMoor et al. disclose all claimed limitations except that the heater elements covered by a conformal protective coating, the coating of each heater element applied substantially to all sides of the heater element such that the coating is seamless.

However, Anagnostopoulos et al. disclose heater elements covered by a conformal protective coating (passivation layer), the coating of each heater element applied substantially to all sides of the heater element such that the coating is seamless (col. 10, lines 33-39 in combination with Figure 5).

Examiner notes the additional limitation that the protective coating is applied simultaneously. However, this limitation pertains only to the method of forming a device, which is not germane to the patentability of the device itself or the method of using the device; therefore, Examiner has not given this limitation patentable weight.

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a protective coating applied substantially to all sides of the heater element into the invention of Campbell et al. as modified by Lebens et al and DeMoor et

Art Unit: 2861

al. The motivation for doing so, as taught by Anagnostopoulos et al., is to protect the heater from the corrosive action of the ink (col. 10, lines 35-37).

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above rejection to Capmbell et al. in view of Lebens et al. and DeMoor et al., which discloses heater elements in the form of a cantilever beam.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

 11/2/06

Shelby Fidler
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